

and Birk, 1925) with the type section in the Cascades formed by a branch of Butternut Creek, southeast of Syracuse, Tully Quadrangle, N. Y.

Little Rock Creek limestone: Proposed for the gray, brittle, conchoidally fracturing limestone above the Logansport limestone on Little Rock Creek above the road-crossing a mile above Lockport, Ind. This formation, 7 feet thick, contains a fauna including a large *Chonetes* called *C. manitobensis*, *Emanuella subumbona*, and a few other species. The lithology and fauna suggest possible relationship to the Tully limestone of New York.

Plum Brook shale: Proposed to replace Plum Creek shale of Grabau, 1917 (not Foerste, 1905, or Ulrich, 1917). Grabau derived his name from Plum Brook, 2 miles northeast of Prout Station, Sandusky Quadrangle, Ohio, but erroneously recorded the name as Plum Creek. The more accurate designation is therefore substituted.

ZOOLOGY. — *A new Solenocera and notes on the other Atlantic American species*.¹ MILTON J. LINDNER and WILLIAM W. ANDERSON, U. S. Fish and Wildlife Service. (Communicated by WALDO L. SCHMITT.)

During the course of the investigation of the shrimp fishery of the Gulf of Mexico undertaken with the Fish and Wildlife Service ship *Pelican* several species of the genus *Solenocera* were captured including the new species that is herein described. The *Pelican* type and paratype have been deposited with the U. S. National Museum. A key to the Atlantic American members of this genus has been prepared in order to provide a means for ready identification of the various species and to set forth the relationship of the new species with the other American forms.

We take considerable pleasure in naming this new species for Dr. Frank W. Weymouth, professor of physiology, Stanford University, California, in recognition of the invaluable counsel, training, and advice that we have received from him. We wish to acknowledge our indebtedness also to Dr. Waldo L. Schmitt, of the U. S. National Museum, for his kindness in furnishing us with material and for his ready and continued assistance in all matters.

Solenocera weymouthi, n. sp.

Fig. 1, a-c

Material examined.—1 ♀, type; *Pelican* station 137-2; 29°28' N., 87°30' W.; March 1, 1939, trawl 46 fathoms.

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1 ♂, paratype; *Pelican* station 137-2; 29°28' N., 87°30' W.; March 1, 1939, trawl 46 fathoms.

1 ♂, allotype; U.S.N.M. no. 119885; Tortugas, August 5, 1932, 190-280 fathoms; boat station 74.

71 ♂ and 78 ♀ paratypes; *Albatross* station 2605; between Cape Hatteras and Cape Lookout, N. C.; 32 fathoms; U. S. National Museum.

Description.—Antennular flagella flattened and canaliculate but not so pronouncedly so as in the other six American species. Pterygostomian spine absent. Pterygostomian angle produced forward into a blunt flaplike projection. Branchiostegal spine absent. Rostrum rather deep with a convex lower margin, which curves upward to a sharp tip; with a distinct lateral ridge and armed above with 7 to 10, usually 8 or 9, teeth of which three lie behind and one above the orbital margin. Postrostral carina does not extend behind level of cervical sulcus. Cervical sulcus deep and well marked, the posterior margin a sharp ridge. Cervical sulcus does not cross dorsum of carapace. Orbital angle bears a distinct sharp-pointed tooth or spine. Antennal angle produced into a sharp-pointed buttressed spine, which is but little larger than the spine in the orbital angle. Postorbital spine large; larger than hepatic, antennal or orbital angle spines and placed about midway between antennal and orbital angle spines.

Ocular peduncle short and stout, eye large. Antennular flagella very short, about seven-tenths carapace length in type female, but in the Tortugas male the antennular flagella is about one-fifth longer than carapace. Inferior flagellum about twice as broad as superior. Antennular peduncle in type female rather densely coated with pubescence but in smaller specimens this condition is less marked. Antennal scale short in most cases, however, in the type female it exceeds the antennular peduncle by about 7.8 per cent of its own length. In many of the smaller specimens available the antennular peduncle exceeds the antennal scale. When an average was taken of the 130 specimens on which measurements were possible, the antennal scale was found to exceed the antennular peduncle by 1.1 per cent of its own length (length of antennal scale); ranging from -4.6 per cent to +8.5 per cent.

In the type female the third maxilliped extends beyond the antennal scale by about the length of its dactyl. Carpus of third periopods slender for their distal half, but on proximal half the leg rapidly thickens and attains approximately the same thickness as the merus. Ischium and basis of first periopods armed on their distal margins with a large sharp spine. Only basis of second periopods armed. Third, fourth, and fifth periopods with basis and ischium unarmed.

In the type female the coxae of the third, fourth, and fifth periopods are produced medially; those of the third almost uniting, those of the fourth produced less than the third and not nearly meeting, and those of the fifth produced even less than the fourth and widely separated. Median projections of coxae of fourth periopods bear a strong sharp tooth or spine on their proximal margins. These spines project mediad over the plate of the thirteenth sternite. Coxae of the fifth periopods bear a small toothlike projection on their anterior margins.

In the Tortugas male the coxae of the third periopods do not appear to be produced medially, those of the fourth produced only slightly, and those of the fifth more than the fourth but none so extensively as in the female. Anterior margins of coxae of fifth legs bear a large toothlike projection.

Although not well adapted for the open type petasma as encountered in this group we are using Burkenroad's (1936, pp. 61-62) terminology for

designating the various petasmas lobes. We do this rather than substitute additional terminology in order not to make the literature more ambiguous than it is at present. Distoventral lobe of mature male subrectangular in shape and equal to or slightly exceeding the cincinnulated median margin of the endopod. Distolateral lobe consists of three distinct lobules the proximal of which can be referred to Burkenroad's lateral lobule of the distolateral lobe. The two distalmost ones appear to be derived from what Burkenroad (1939) terms the median lobule in *Solenocera atlantidis*; the proximal of these we shall designate as the median lobule and the distal most as the distal

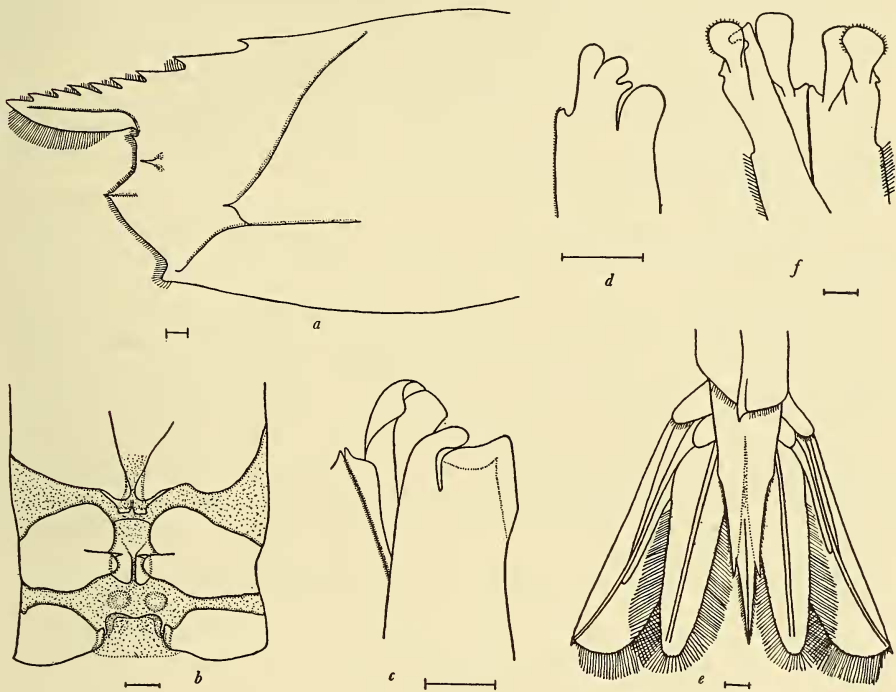


Fig. 1.—*Solenocera weymouthi*, n. sp.: a, Carapace, anterior part, lateral view (type female); b, thelycum, ventral view (type female); c, petasma, posterior view of distal part (left endopod) (allotype); d, petasma, immature, posterior view of distal part (left endopod); e, telson and uropods, dorsal view (type female). f, *Solenocera necopina* Burkenroad: Petasma, posterior view of distal portion. Scale = 1 mm.

lobule. In the mature male the lateral lobule of the distolateral lobe is semi-hook shape and curves over approximately the median half of the distoventral lobe. Median lobule of the distolateral lobe bulbous or knob like and superior to both the lateral lobule and the distoventral lobe. Distal lobule of the distolateral lobe is superior to the other petasmas structures and folds as a semi-membranous hood over the median lobule in much the fashion of a sun-bonnet.

Paired teeth on anterior part of fourteenth sternite of female, which in all other species of *Solenocera* from both the Pacific and Atlantic coasts of North America are very prominent, are in *S. weymouthi* very much reduced in size and appear as a pair of well separated short blunt protuberances. Bilobed

ridge evident near the center of the fourteenth sternite slightly forward of median projections of coxae of fifth pereopods. Plate of thirteenth sternite with a deep well marked longitudinal sulcus down the center. A pair of large blunt projections arise from posterior part of twelfth sternite and project over anterior portion of thirteenth. Entire thelycum pubescent.

Epipodites through the twelfth deeply bifurcated, shorter ramus one-half or more the length of longer ramus. Epipodites of thirteenth somite shallowly bifurcated.

In the type female the first and second pleonic terga are uncarinated; posterior two-thirds of the third carinated, the fourth, fifth, and sixth with a high sharp carina. On smaller specimens carina of third pleonic tergite is less pronounced or not evident, apparently this varies with age. Posterodorsal and posteroventral angles of sixth pleonic tergite ending in a spine.

Telson long terminating in a sharp point; bears a large pair of fixed lateral spines; anterior half of dorsal surface with a median sulcus bordered by two ridges which terminate in the lateral spines; posterior half bears a distinct median carina which extends nearly to the sharp tip.

Uropodal endopods slightly exceed tip of telson and exopods of uropod exceed endopods by approximately the same distance that endopods exceed telson. Externodistal margins of uropodal exopods armed with a tooth or spine.

Measurements.—*S. weymouthi*, like *S. atlantidis* and *S. necopina*, appears to be a comparatively small species of shrimp not attaining a size much larger than the type female with carapace length of 17.5 mm. *S. vioscai*, on the other hand, reaches a size much larger. A majority of the specimens of *S. weymouthi* from the North Carolina coast, with carapace lengths ranging from 4.2 to 8.4 mm, which comprises the bulk of available material, was immature. In the males the petasmal endopods were not united, and the lobes were poorly developed in most cases. The male from Tortugas with carapace length of 10.3 mm was mature with the endopods united and the lobes well developed.

Distribution.—As at present known *S. weymouthi* occurs from North Carolina to Alabama.

Remarks.—So far as known *S. weymouthi* differs from all other members of the genus with the exception of *S. melantho* De Man and *S. steindachneri* (Balss) in its possession of a tooth or spine on the externodistal margin of the exopod of the uropod (Burkenroad, 1936, pp. 105, 121).

S. weymouthi is further distinct from *S. agassizii* Faxon, *S. membranacea* (Risso), *S. m. africanus* Stebbing, *S. comatus* Stebbing, *S. novae-zealandi* Borradaile, *S. vioscai* Burkenroad, *S. atlantidis* Burkenroad, *S. necopina* Burkenroad, *S. florea* Burkenroad, *S. mutator* Burkenroad, *S. faxoni* De Man, *S. distincta* De Haan, *S. (Parasolenocera) annectans* Wood-Mason, and possibly *S. crassicornis* H. Milne-Edwards (1837) in that it possesses neither a pterygostomial nor a branchiostegal spine. *S. weymouthi* further differs from *S. crassicornis* in its possession of a pair of fixed lateral spines on the telson; these spines are reported as absent in *S. crassicornis* (Burkenroad, 1934, p. 72).

From those members of the genus that like *S. weymouthi* possess neither pterygostomial nor branchiostegal spines, *S. weymouthi* in addition to the possession of a spine on the externodistal margin of the exopod of the uropod (except *S. melantho* and *S. steindachneri*) differs as follows:

In *S. hextii* Wood-Mason the postrostral carina extends to the posterior

margin of the carapace whereas in *S. weymouthi* the postrostral carina does not continue beyond the level of the cervical sulcus. In the males of *S. hextii* the cincinnulated median margin of the petasma extends beyond the distoventral lobe whereas in *S. weymouthi* the cincinnulated median margin of the petasma falls at about the level of the distoventral lobe. In *S. hextii* the pair of knobs on the fourteenth sternite of the female are placed together whereas in *S. weymouthi* they are well separated. *S. hextii* has a spine on the cervical carina dorsad the hepatic spine which is not present in *S. weymouthi*.

In *S. koelbeli* De Man the postrostral carina extends to the posterior margin of the carapace whereas in *S. weymouthi* the postrostral carina does not cross the level of the cervical sulcus. In *S. koelbeli* the cervical sulcus makes a notch in the dorsal carina of the carapace whereas in *S. weymouthi* there is no notch in the dorsal carina.

S. rathbuni Ramadan has no spine at the orbital angle whereas *S. weymouthi* has a large sharp spine at the orbital angle. In *S. rathbuni* the epipodites through the thirteenth are deeply bifurcated whereas in *S. weymouthi* the epipodites through the twelfth are deeply bifurcated with the thirteenth only shallowly bifurcated.

S. pectinatus (Bate) does not have the orbital angle armed whereas *S. weymouthi* has a large sharp spine at the orbital angle. The petasma of *S. pectinatus* has a series of large comblike spines on the outer surfaces of the distolateral lobes which are not present in *S. weymouthi*. The petasma of *S. pectinatus* is cincinnulated along its median margin much higher than occurs in *S. weymouthi* and differs widely from it in structure.

S. melantho De Man has a well-defined postrostral carina extending nearly to the posterior margin of the carapace whereas in *S. weymouthi* the postrostral carina does not cross the level of the cervical groove. The paired knobs on the fourteenth sternite of the thelycum are placed together whereas in *S. weymouthi* they are well separated. The cincinnulated median margin of the petasma extends much higher in *S. melantho* than in *S. weymouthi*.

In *S. steindachneri* (Balss) the cincinnulated median margin of the petasma extends considerably beyond that in *S. weymouthi*. Furthermore Balss figures a dorsal carapacic spine posterior to the cervical groove. This is lacking in *S. weymouthi*.

The cincinnulated median margin of the petasma of *S. weymouthi* appears to resemble more closely those *Solenocera* possessing branchiostegal or pterygostomial spines than those lacking these spines.

S. weymouthi like other species of the genus from the Atlantic coast of the United States is variable in the matter of the antennal scale exceeding the antennular peduncle, varying from the antennular peduncle exceeding the antennal scale to the scale exceeding the peduncle by 8.5 per cent of its own length. In *S. atlantidis* measurements on 17 specimens from the United States National Museum show that the antennal scale varies from shorter than the antennular peduncle to exceeding it by about 7 per cent of its own length with an average of 1.3 per cent longer. *S. vioscai* agrees very closely in this character (Burkenroad, 1939, p. 15) with *S. weymouthi* and *S. atlantidis*. *S. necopina*, on the other hand, has a longer antennal scale than the other three Atlantic American species. Measurements on 18 specimens of *S. necopina* from the United States National Museum reveal that the antennal scale exceeds the antennular peduncle from over 13 per cent to 24 per cent its own length with an average of 17 per cent longer. Therefore, this character can be used to separate *S. necopina* from the three other species under consideration.

Solenocera necopina Burkenroad

Fig. 1, f

Solenocera vioscai Burkenroad, 1936, p. 122.*Solenocera necopina* Burkenroad, 1939, p. 7.*Material*.—9♂ and 10♀ and several broken shrimps; U.S.N.M. no. 9767; Albatross station 2402; Gulf of Mexico.

Burkenroad, 1939, described this species of *Solenocera* from a single sub-adult female taken at the edge of the Continental Shelf in the Northern Gulf of Mexico in 125 fathoms of water. There were found in the United States National Museum 19 whole and several broken shrimp that were determined as this species. As Burkenroad was unable to give an account of the male petasma there follows a description of this organ.

Median margin of petasma similar to *S. vioscai* Burkenroad in that it is cincinnulated for about two-thirds the length of the petasma and falls considerably below distolateral and distoventral lobes. Distoventral lobe provided with a rounded projection margined with spines. Distolateral lobe divided into two lobules. Lateral lobule slightly shorter than median lobule and distoventral projection; possessing a slender lateral projection which in posterior view is hidden behind projection of distoventral lobe. Median lobule of distolateral lobe broad, subrectangular or club shaped, slightly exceeding lateral lobule and about equal to spinous distoventral projection.

Females in the United States National Museum collection agree with Burkenroad's description of the thelycum except that the sculpture is much more pronounced and the teeth and ridges are more developed in the mature specimens

Males in the series of specimens ranged from a carapace length of 9.8 to 13.1 mm and the females from 11.4 to 18.4 mm all of which appear mature. The largest specimen in the collection, a female, had its carapace so badly crushed as to make accurate measurements impossible.

The orbital angle was described as marked but not acute or produced. In the larger specimens the orbital angle while not sharp or spinelike is definitely produced.

Burkenroad's statement (1939, p. 7) that the postrostral carina does not extend behind the level of the cervical sulcus is erroneous for large specimens as in these there is a definite low carina extending nearly to the posterior margin of the carapace. Burkenroad (*loc. cit.*) states that the first through the third pleonic terga are uncarinated. Here again we find that in large specimens the third pleonic tergite is carinated on its dorsal surface for approximately the posterior two-thirds of its length.

Burkenroad's figure of *S. necopina* does not show a spine or tooth on the posteroventral edge of the sixth pleonic tergite. Our specimens have a spine at this point which compares in size and position to a similar spine in *S. atlantidis*.

In large specimens of *S. atlantidis* the postrostral carina does not extend beyond the cervical sulcus as stated by Burkenroad (*loc. cit.*), but we find that in these same specimens the third pleonic tergite is partially carinate. This carination is not evident in the smaller specimens.

The pterygostomial spine in *S. necopina* is much stronger and possesses a wider base than does this structure in similar sided specimens of *S. atlantidis*.

KEY TO ATLANTIC AMERICAN SOLENOCERA

- A. Pterygostomial spine present. No spine on externodistal margin of uropodal exopod.

- B. Epipodites X through XIII strongly bifurcate, shorter ramus at least half the length of undivided portion excluding peduncle. Pacific American species.
 *agassizii* Faxon, *mutator* Burkenroad, *florea* Burkenroad
- BB. Epipodites X through XIII only slightly furcate, shorter ramus not more than one-third the length of undivided portion excluding peduncle. Atlantic American species.
- C. Rostral teeth 8 to 10, usually 9. Postrostral carina high and sharp, deeply notched at level of cervical groove. *vioscai* Burkenroad
- CC. Rostral teeth 5 to 7, usually 6. Postrostral carina low or absent, only slightly depressed at level of cervical groove.
- D. Antennal scale long, exceeding antennular peduncle by at least 13 per cent its own length. No well defined tooth at orbital angle. Pterygostomial spine large with wide base, joining carapace in a gentle curve. *necopina* Burkenroad
- DD. Antennal scale short, less than antennular peduncle to exceed-ing antennular peduncle by about 8 per cent of its own length. A well defined tooth at orbital angle. Pterygostomial spine small with narrow base, joining carapace at approximately a right angle. *atlantidis* Burkenroad
- AA. Pterygostomial spine absent. Spine on externodistal margin of uropodal exopod. *weymouthi*, n. sp.

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